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मानक

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IS 5351 (2001): Textiles - Polyester Fiber Woven Tape for Electrical Insulation Purposes [TXD 12: Narrow Fabrics, Webbing and Braids]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

वस्त्रादि — विद्युत रोधक कार्यों के लिए पोलिएस्टर रेशे
से बुनी टेपें — विशिष्टि
(दूसरा पुनरीक्षण)

Indian Standard

TEXTILES — POLYESTER FIBRE WOVEN
TAPES FOR ELECTRICAL
INSULATION PURPOSES — SPECIFICATION
(*Second Revision*)

ICS 29.035.20; 59.060.20

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Narrow Fabrics, Webbing and Braids Sectional Committee, had been approved by the Textile Division Council.

This Indian Standard published in 1969 was first revised in 1975. It is again being revised to cover four types of tapes woven on conventional or shuttleless looms from polyester yarn (with or without heat-setting) having low, medium and high shrinkages. While preparing this standard, considerable assistance has been derived from IEC 1068 : 1991 'Specification for polyester fibre woven tapes — Part 1 : Definitions, designation and general requirements; Part 2 : Methods of test; Part 3 : Specification for individual materials, Sheet 1 : Tapes woven on conventional or shuttleless looms', issued by the International Electrotechnical Commission (IEC).

In electrical industry, woven polyester tape is used as an electrical insulation in the coils, which are subsequently air dried and impregnated with thermosetting varnish. During drying process, polyester tape shrinks and improves the consolidation of coil. Therefore, optimum thermal shrinkage is desired in woven polyester tape as lower thermal shrinkage will not improve consolidation and extremely high thermal shrinkage will result in excessive stresses in tape, thereby weakening it.

The composition of the committee responsible for formulation of this Standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — POLYESTER FIBRE WOVEN TAPES FOR ELECTRICAL INSULATION PURPOSES — SPECIFICATION (*Second Revision*)

1 SCOPE

1.1 This standard prescribes constructional particulars and other requirements of four types of polyester fibre tapes woven on conventional or shuttleless looms used for electrical insulation.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
1954:1990	Method for determination of length and width of fabrics (<i>second revision</i>)
5352 (Part 2): 1999	Textiles — Glass and glass — Polyester fibre woven tapes : Part 2 Methods of test (<i>third revision</i>)

3 CLASSIFICATION

The tapes are classified into following four types:

- a) *Type 1* — Tapes woven from polyester yarn so as to produce a tape with high shrinkage.
- b) *Types 2 and 3* — Tapes woven from heat-set polyester yarn so as to produce a tape with low shrinkage.
- c) *Type 4* — Tape woven from heat-set polyester yarn so as to produce a tape with medium shrinkage.

4 MANUFACTURE

4.1 Yarn

The polyester yarn used in the manufacture of tapes shall be continuous filament polyethylene terephthalate (PET) and for Types 2, 3 and 4 it shall be heat-set.

4.2 Weave

The tape shall be woven in plain weave with selvages. The selvages shall be uniform. The tape shall be in

the loom-state condition and shall not be calendered.

4.3 Locking Thread

In case of tape woven on shuttleless looms, the picks shall be interlocked at or near the selvedge opposite the one from which the weft is inserted thus preventing unravelling of the selvedge during use. The method of interlacing shall be such that the thread cannot be pulled out of the body of the tape.

4.4 Centre Marking

Centre line/markings of any colour may be provided if specified by the buyer.

4.5 Identification of Types of Tapes

Tapes shall be identified according to types as follows:

- a) *Type 1* — A single coloured warp thread positioned so as to indicate the centre line of the tape.
- b) *Type 2* — Two coloured warp threads close together and positioned so as to indicate the centre line of the tape.
- c) *Type 3* — Three coloured warp threads close together and positioned so as to indicate the centre line of the tape.
- d) *Type 4* — Four coloured warp threads close together and positioned so as to indicate the centre line of the tape.

5 REQUIREMENTS

5.1 Thickness

The nominal thickness measured between the selvages of a tape shall comply with the values given in Table 1. Thickness, when measured at the selvages, shall not exceed the thickness between the selvages by more than 0.03 mm. The thickness of tapes shall be determined by the method prescribed in IS 5352 (Part 2).

5.2 Width

The nominal width of a tape shall comply with the values given in Table 2. The width of tapes as determined in accordance with the method given in

IS 5352 (Part 2), shall not differ by more than $\pm 1.0\text{mm}$.

Table 1 Thickness and Tolerance
(Clause 5.1)

Nominal Thickness	Minimum Thickness	Maximum Thickness
mm	mm	mm
(1)	(2)	(3)
0.13	0.12	0.17
0.20	0.17	0.22
0.25	0.22	0.27

Table 2 Nominal Width
(Clause 5.2)

Tape Type	Nominal Thickness	Nominal Width
	mm	mm
(1)	(2)	(3)
1	0.13	15-25
2, 3 and 4	0.13	15-20-25
2, 3 and 4	0.20	15-20-25
2, 3 and 4	0.25	15-25

5.3 Length

5.3.1 Unless otherwise specified, the tape shall be supplied on rolls in 50 m length. The number of joints per roll shall not exceed two and none of the tape piece in a roll shall be shorter than 10 m. The length of the tape in each roll shall be determined by the method prescribed in IS 1954.

5.3.2 In case of roll with joints, the tape pieces shall be butted and joined up by a strip of coloured gummed tape which shall show on the edge of roll to indicate the presence of joints. Pins or other metal fasteners shall not be used for securing the ends of rolls or for joining the tapes.

5.3.3 In any consignment, the number of rolls having joints shall not exceed by more than 10 percent.

5.4 Other Requirements

The tapes shall also conform to the requirements given in Table 3.

6 PACKING

6.1 Winding

6.1.1 The tape shall be wound on a hard tubular core with sufficient tension to form a compact roll but without deforming the construction of the tape. The internal diameter of core construction of the tape shall not be less than 10 mm and not more than 13 mm and its width shall be approximately the same as the width of the tape but shall not exceed it. The roll shall not get loosened when dropped on floor from a height of one metre. Alternatively individual core having a diameter of 55 mm is also permitted.

Table 3 Requirements for Tapes
(Clause 5.4)

Sl No.	Characteristic	Nominal Thickness	Requirement				Method of Test, Ref to
			Type 1	Type 2	Type 3	Type 4	
(1)	(2)	(mm) (3)	(4)	(5)	(6)	(7)	(8)
i)	Ends/cm, Min	0.13	20	30	24	24	Clause 3.1 of IS 5352 (Part 2)
		0.20	20	30	24	24	
		0.25	20	30	24	24	
ii)	Picks/cm, Min	0.13	12	15	15	15	Clause 3.1 of IS 5352 (Part 2)
		0.20	12	15	15	15	
		0.25	12	15	15	15	
iii)	Shrinkage length (%)	0.13	>12	<5	<5	5-12	Annex A
		0.20	>12	<5	<5	5-12	
		0.25	>12	<5	<5	5-12	
iv)	Shrinkage width (%)	0.13	NR	<5 or 1 mm whichever is greater	<5 or 1 mm whichever is greater	NR	Annex A
		0.20	NR			NR	
		0.25	NR			NR	
v)	Tensile strength (N/mm)	0.13	≥25	≥15	≥15	≥15	Clause 3.5 of IS 5352 (Part 2)
		0.20	≥40	≥35	≥35	≥35	
		0.25	≥60	≥50	≥50	≥50	
vi)	Force/10 mm tape width developed when heated at 150°C (N)	0.13	≥15	NA	NA	NA	Annex A
		0.20	≥20	NA	NA	NA	
		0.25	≥25	NA	NA	NA	

NR — No requirement; NA — Not applicable.

6.1.2 The tapes shall be wound in an anti-clockwise spiral when the roll is viewed from the locking thread, as shown in Fig. 1.

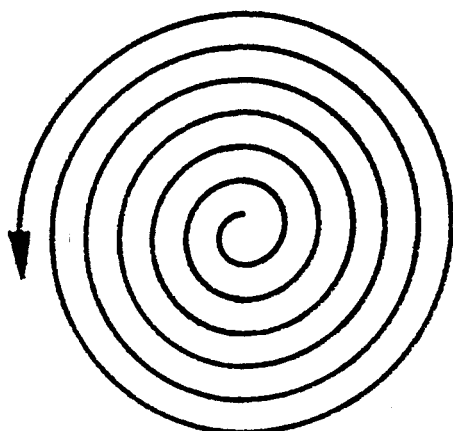


FIG. 1 VIEW OF ROLL FROM LOCKING THREAD SIDE

7 MARKING

7.1 Outer end of tapes of each roll shall be tied with the label bearing the following information:

- Type of tape;
- Length of roll in metres;
- Nominal thickness and width of tape in millimeters;
- Manufacturer's name, initials or trade-mark, if any; and
- Year of manufacture.

7.1.1 BIS Certification Marking

Each roll may also be marked with the Standard Mark.

7.1.2 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

7.2 Package containing number of rolls as agreed to between the buyer and the seller shall be marked with the following;

- Number of rolls in the package;
- Type of tape;
- Length of roll in metres;
- Nominal thickness and width of tapes in millimetres;
- Manufacturers' name, initials or trade-mark, if any; and
- Year of manufacture.

8 SAMPLING

8.1 Lot

The quantity of tape of one definite type delivered to one buyer against one despatch note shall constitute a lot.

8.2 The conformity of a lot to the requirements of this standard shall be determined on the basis of test carried out on rolls of tape selected from the lot.

8.3 Unless otherwise specified, the number of rolls of tape to be selected at random from a lot shall be as given in Table 4.

8.4 For evaluating width, length, ends per centimetre, picks per centimeter and thickness, the number of rolls selected in col 2 of Table 4 shall constitute the test sample.

8.5 For evaluating tensile strength, shrinkage length percent, shrinkage width percent and force per 10 mm tape width developed when heated at 150°C, the number of rolls selected in col 4 of Table 4 shall constitute the test sample. The rolls shall be selected at random from those drawn for the purpose of 8.4. The required test specimens shall be drawn from each of the rolls and subjected to corresponding tests.

8.6 Criteria for Conformity

The lot shall be considered as conforming to the requirements of the standard if the following conditions are satisfied:

- The number of rolls found defective for any one or more of the characteristics mentioned in 8.4 does not exceed the corresponding number given in col 3 of Table 4.
- None of the test samples fails to meet the specified requirement in respect of the characteristics mentioned in 8.5.

Table 4 Sample Size and Criteria for Conformity
(Clauses 8.3, 8.4, 8.5 and 8.6)

Lot Size (Number of Rolls)	Sample Size	Permissible Number of Defective Rolls	Sub Sample Size
(1)	(2)	(3)	(4)
Up to 100	5	0	2
101 to 300	13	0	3
301 to 500	20	1	5
501 to 1 000	32	2	8
1 001 to above	50	3	8

ANNEX A

(Table 3)

METHODS OF TEST

A-1 DETERMINATION OF SHRINKAGE**A-1.1 Test Pieces**

From each of the five rolls selected at random cut a test piece sufficiently long to be able to mark on it a distance of 500 mm.

A-1.2 Procedure

Lay the test piece flat on a smooth surface. Apply no more tension to the tape than is necessary to make it lie straight and flat. Measure the marked length and width (when the shrinkage on width is required) to within ± 0.5 mm. Make two measurements of each of the required dimensions on each of the five test pieces. Place the test pieces in an oven which is maintained at $155 \pm 5^\circ\text{C}$. The test pieces shall be loosely coiled to allow free circulation of air. After $60 \text{ min} \pm 10 \text{ min}$ at 155°C exposure, remove the test pieces and cool for 1 h at 15°C to 35°C . Repeat the earlier measurements of length and width.

A-1.3 Results

A-1.3.1 Take the central value of the ten measurements before and after heating and express the result as a percentage, that is:

$$100 - \frac{\text{Length or width after heating}}{\text{Length or width before heating}} \times 100$$

A-1.3.2 Report also the central value of the shrinkage in width in millimetres.

NOTE — Central value is the middle value of an odd number of test measurements or the mean of the two middle values of an even number of test measurements when these measurements are arranged in order of magnitude.

A-2 DETERMINATION OF FORCE DEVELOPED WHEN HEATED AT 150°C **A-2.1 Test Specimen**

Approximately 150 mm length of the tape.

A-2.2 Test Apparatus

Tensile tester with oven.

A-2.3 Procedure

Fix the piece in the tester in suitable jaws 100 mm apart. The jaws shall be in an oven. Apply a load of nominally 5 percent of the estimated breaking load. Raise the temperature in the oven from room temperature to $155 \pm 5^\circ\text{C}$ in 10 to 15 min. Record the maximum force exerted by the test piece.

A-2.4 Results

Take the central value of three measurements.

ANNEX B**(Foreword)****COMMITTEE COMPOSITION****Narrow Fabrics, Webbing and Braids Sectional Committee, TX 12**

<i>Organization</i>	<i>Representative(s)</i>
Ministry of Defence (DGQA), New Delhi	SHRI A. K. BANDYOPADHYAY (<i>Chairman</i>) SHRI D. K. SRIVASTAVA (<i>Alternate I</i>) SHRI S. K. CHAKRABORTY (<i>Alternate II</i>)
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Directorate General of Supplies & Disposals (Inspection Wing), New Delhi	SHRI D. S. MARTOLIYA SHRI T. K. MUKHERJEE (<i>Alternate</i>)
Garware-Wall Ropes Ltd, Pune	SHRI R. R. SARDESAI SHRI S. J. CHITNIS (<i>Alternate</i>)
M. Best Cotton Rope Mfg Co, Mumbai	SHRI HEMAL M. THANAWALA
Ministry of Defence (R&D), Kanpur	SHRI ANURAG SRIVASTAVA SHRI R. INDU SHEKHAR (<i>Alternate</i>)
Motilal Dulichand Pvt Ltd, Kanpur	SHRI SUNIL PRAHLADKA SHRI RAVI NEMANI (<i>Alternate</i>)
Narrow Elastic Manufacturers Association of India, Mumbai	SHRI HIRALAL ARORA
Newtex Insulations Pvt Ltd, Nasik	SHRI SANJEEV KAUSHIK
Office of the Textile Commissioner, Mumbai	SHRI S. P. KALA SHRI S. CHAKRABARTY (<i>Alternate</i>)
Southern Group Industries (Pvt) Ltd, New Delhi	SHRI BIMAL P. MAHESHWARI SHRI K. B. SRINIVASLOO (<i>Alternate</i>)
Spica Plastic, Pune	SHRI R. C. JAITHA SHRI S. K. JAITHA (<i>Alternate</i>)
Textiles Committee, Mumbai	SHRI N. JEEVA SHRI A. K. SEN (<i>Alternate</i>)
The Bombay Textile Research Association, Mumbai	SHRI U. K. GANGOPADHYAY SHRI R. N. BHARATI (<i>Alternate</i>)
The Silk & Art Silk Mills Research Association, Mumbai	SHRI V. J. GARG SHRI B. V. DOCTOR (<i>Alternate</i>)
The South India Textile Research Association, Coimbatore	DR S. S. RAMASAMY
Todi Industries Ltd, Mumbai	SHRI S. B. TODI SHRI N. B. TODI (<i>Alternate</i>)
Zebra Weblift Pvt Ltd	SHRI ABDULKADER A. LOKHANDWALA SHRI KAISER A. LOKHANDWALA (<i>Alternate</i>)
BIS Directorate General	SHRI R. K. DUA, Director and Head (TXD) [Representing Director General (<i>Ex-officio Member</i>)]

Member-Secretary

SHRI M. S. VERMA
Director (TXD), BIS

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